NOVEMBER/DECEMBER 2024

23PCH32 — COORDINATION CHEMISTRY – I

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Compare π-donor ligands and π-acceptor ligands with examples.

2. Calculate the crystal field stabilization energy for the d^2 ion in O_h field.

3. Define nephelauxetic effect.

4. Determine the term symbol for the ground state of Ti^{3+} ion.

5. Calculate the magnetic moment for low-spin and high-spin Cr^{2+} ions using the spin-only formula.

6. What is Irving – Williams series?

7. Define trans effect.

8. Distinguish between the Curie temperature and the Neel temperature.

9. Calculate the LFSE for both high-spin and low-spin d^7 ions

10. Summarize the application of the Marcus-Hush theory.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Discuss the factors affecting 10Dq.

Or

(b) Explain the Jahn–Teller distortion with an example.

12. (a) Summarize the spin selection rule for electronic transitions.

Or

(b) The electronic transition for high-spin $[Mn(H_2O)6]^{2+}$ is spin-forbidden while for $[Mn(H_2O)6]^{2+}$ is spin-allowed. Why?

13. (a) Brief note on the following

(i) Spin-orbit coupling

(ii) Kinetic Stability of complexes

Or

(b) What is the chelate effect? Relate the thermodynamic stability and chelation.

14. (a) Explain SN1CB mechanism.

Or

(b) Discuss the acid and base hydrolysis of octahedral complexes.

15. (a) Explain the photo-isomerisation reactions with illustration.

Or

(b) Explain the photo-redox and phot-substitution reactions with example.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Discuss the splitting of the d orbitals in an octahedral crystal field.

17. Construct the Orgel diagram for d^1, d^9, d^4, d^6 systems in octahedral ligand fields.

18. Examine the factors that influence the stability of metal complexes.

19. Explain the ligand substitution reaction based on associative and dissociative mechanistic pathways.

20. Elaborate outer-sphere electron transfer reactions with a suitable example.

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